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Simulations of Abstract Autopoietic Machines

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According to [Maturana and Varela 1980], autopoiesis is at the basis of autonomy and cognition. Consequently, some artificial life works aimed at simulating artificial autopoiesis [Beer 2004, McMullin 2004]. Generally, the purpose is to maintain a topological organization of automata. At the opposite, we consider that simulation can override topological aspects because topology has no significance in the computational domain. More important is to preserve self-regeneration and resistance to disturbances of an *Abstract Autopoietic Machine (AAM)*. The long term goal of our work is to address the elucidation of the Rosen conjecture - i.e. *that a model of life defined as closure under efficient cause cannot be instantiated by a computer simulation* – which is called into question by [Stewart and Miosso 2007] – which say that *closure under efficient causation does not represent a theoretical problem for calculability* - [Letelier et al. 2003] showed that autopoiesis is less general but very close to (M,R) System. Nevertheless, we can't claim that we simulate (M,R) systems because our model lack on a full loop allowing the use of produced data as an executive code.

Formally, an AAM is a tuple $\{E, F\}$:

- E is a multiset (N, m) of abstract particles defined by an integer.
 $N \subset \mathbb{N}$ is the *underlying* set of E . It is representative of the self of the AAM
 $m: N \rightarrow \mathbb{N}_{\geq 1}$ is the multiplicity function, i.e the number of occurrence of x in E is $m(x)$.
- $F = \{f | f: E \times E \rightarrow E^2\}$ is a set of interaction functions. Each interaction function transforms a couple of abstract particles to another couple of abstract particle.

The dynamic of an AAM is executed into another multiset $Env=(N_{env},m_{env})$ representative of an abstract environment. It is defined by these principles:

- Env is initialized with E ($Env=E$)
- f in F are chosen randomly and applied indefinitely to couples of elements of Env which are also chosen randomly. The result is introduced in Env. If $N_{env} \subset N$ during this evolution, the AAM machine is stable and closed. Else, the AAM is unstable and elements of $N \cap N_{ew}$ are its nonself.
- A perturbation consists in introducing some elements in Env. The reaction of the AAM is the dynamic of the evolution of the set $N \cap N_{ew}$.

The presentation will show results of these simulations. More precisely:

- The influence of E and F on the resistance to different perturbations.
- The regularities on reactions coming from disturbances.

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